

# Observations from snow depth sensor arrays representing diverse forest conditions during NASA's SnowEX 2017 campaign



Photo: N. Wright



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# Objectives

- Continuously measure snow depth
  - 15 min time step
- Capture snow depth dynamics in representative forest conditions at East and West Mesa sites
- Produce serially complete snow depth data product to be used by SnowEX community

# Depth Sensor Arrays

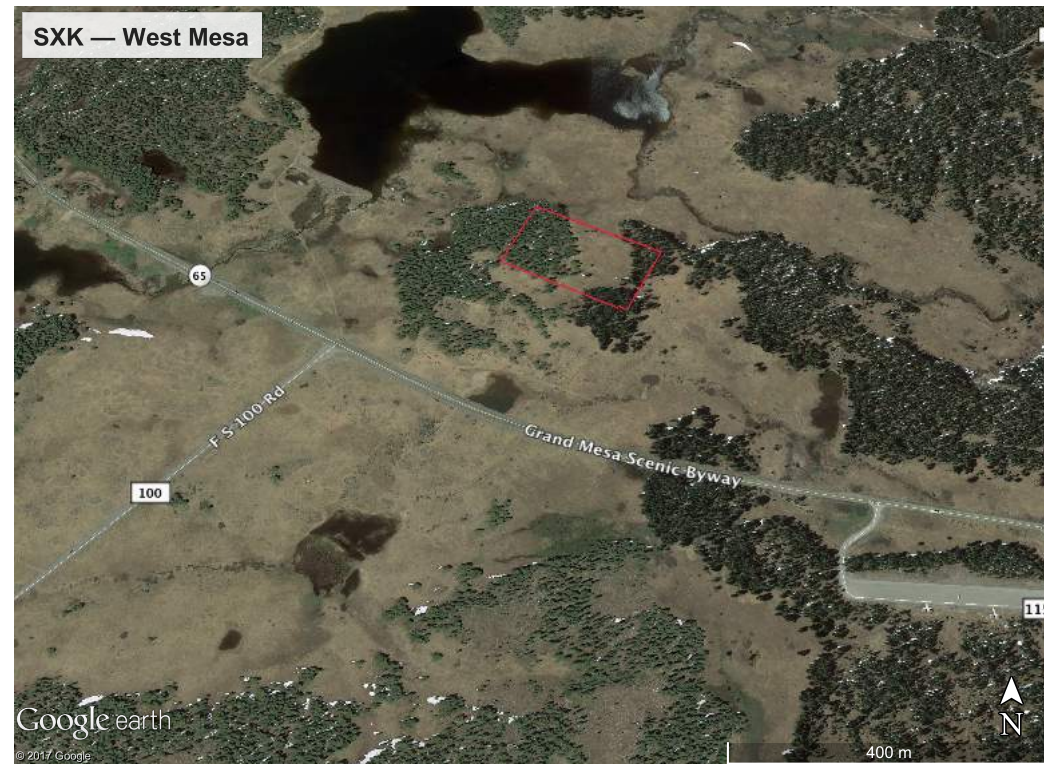
- Judd Communications ultrasonic depth sensors (10x per array)
  - Nominal accuracy:  $\pm 1$  cm
  - Beam width:  $22^\circ$  (~1.1 m footprint)
  - Geolocated with post-processed DGPS
- Solar powered grid
- 3 representative forest conditions
  - Open, edge, and under-canopy





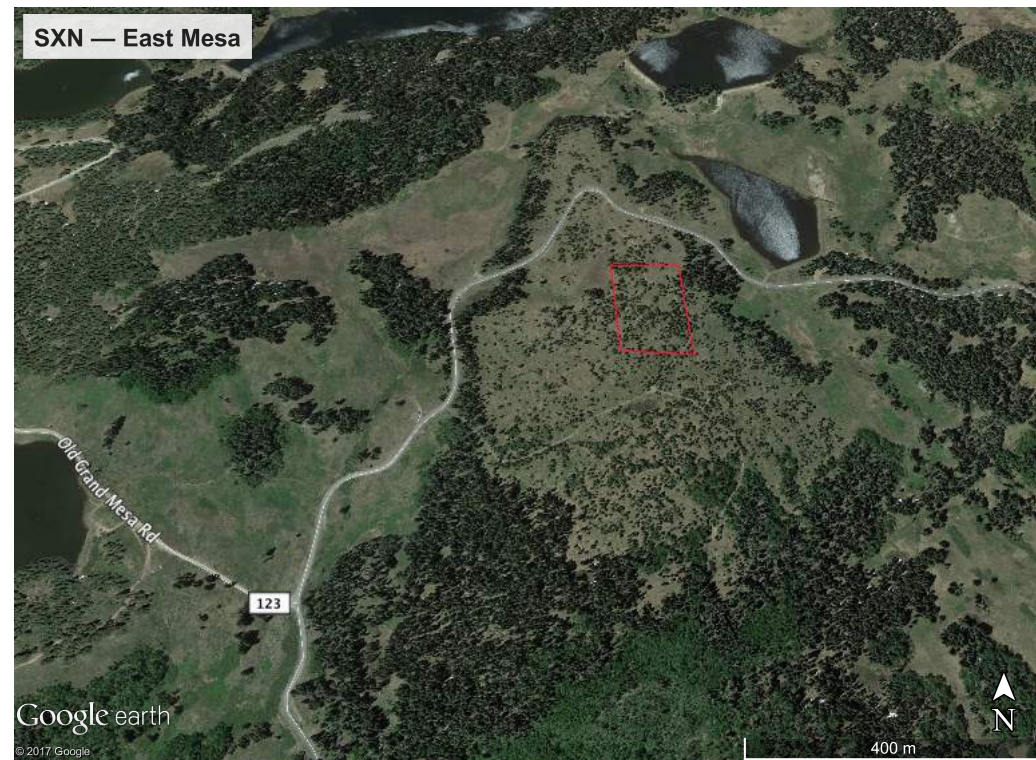
# Study Sites: SXX

- SXX (3255 m)
  - Flat terrain
  - Dense vegetation to west, open to east



# Study Sites: SXN

- SXN (3058 m)
  - Rolling terrain
  - Moderate vegetation coverage throughout





# Forest Conditions: Open



# Forest Conditions: Edge





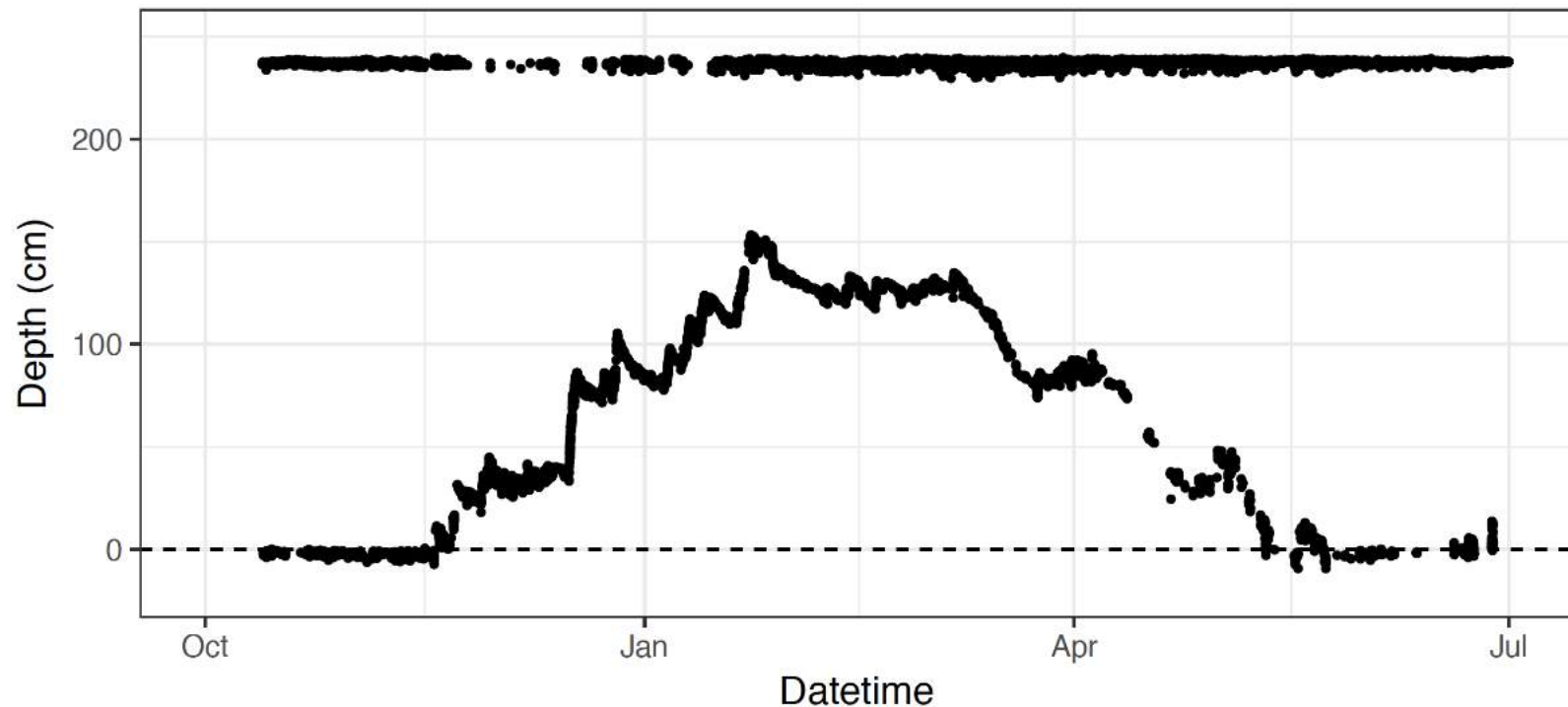
# Forest Conditions: Under-Canopy





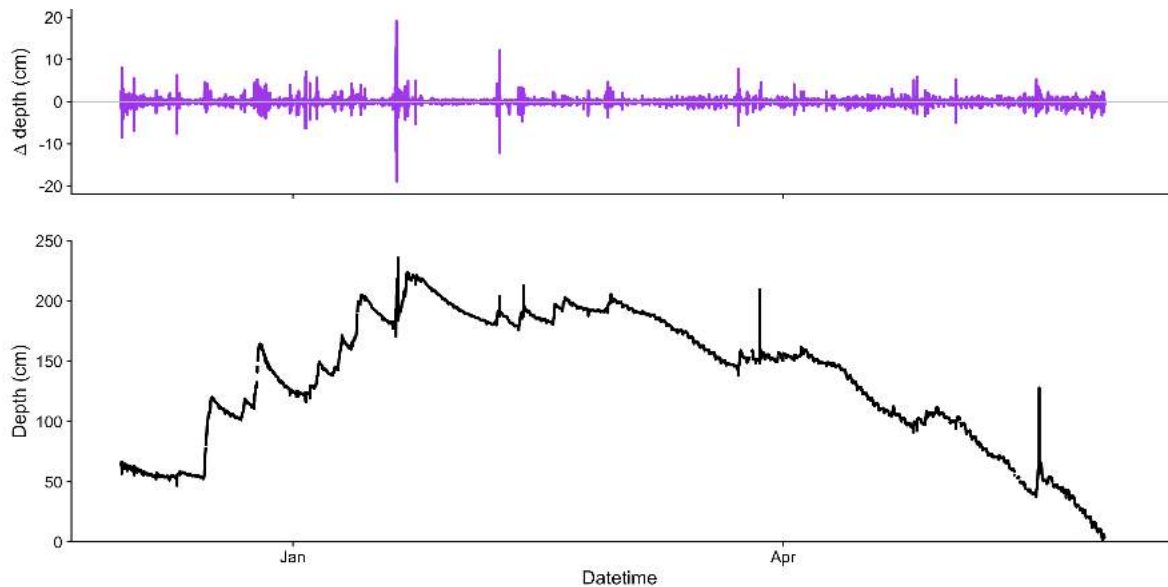
# Data Issues

SXK Snow Depth Sensor 5



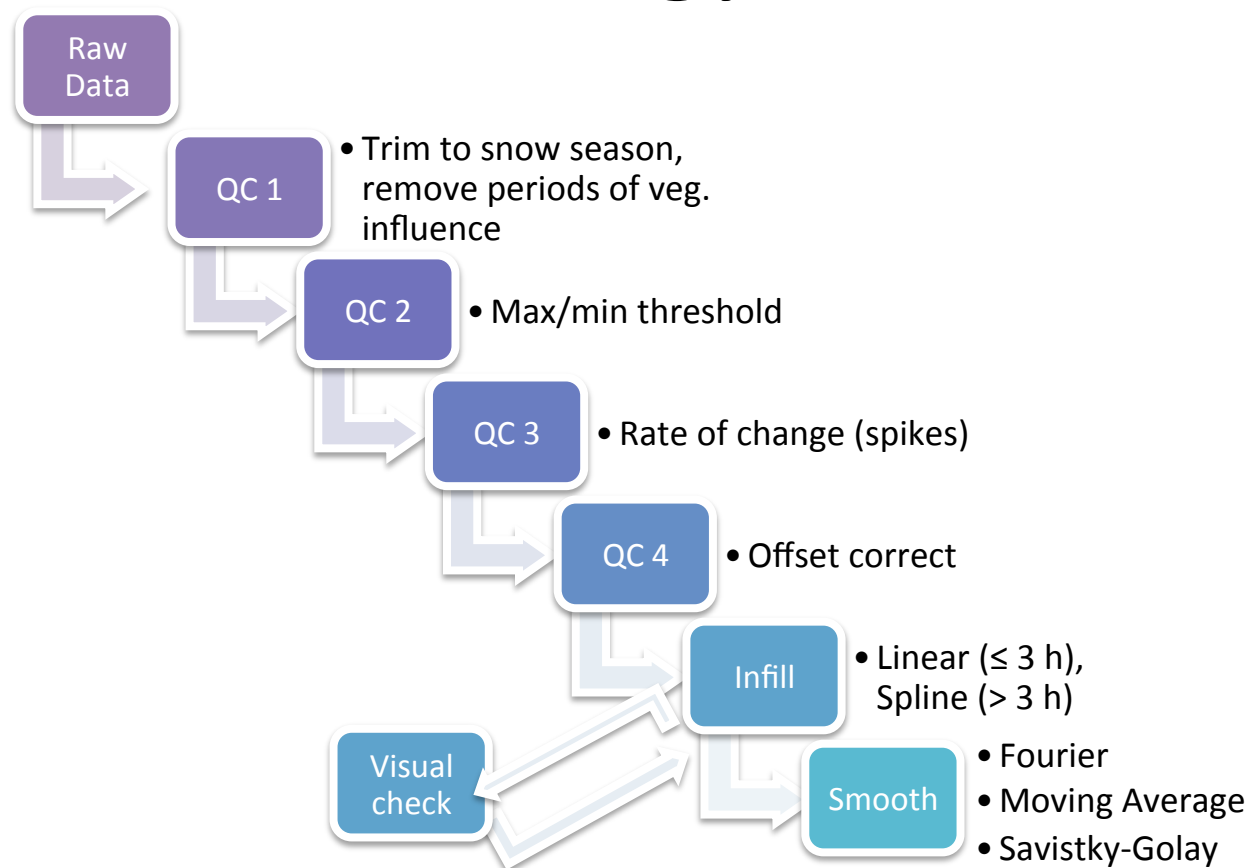
# Data Issues

- Unrealistically high/low measurements
- Spikes and noise in data
- Vegetation effects
- Data gaps
- Offset bias



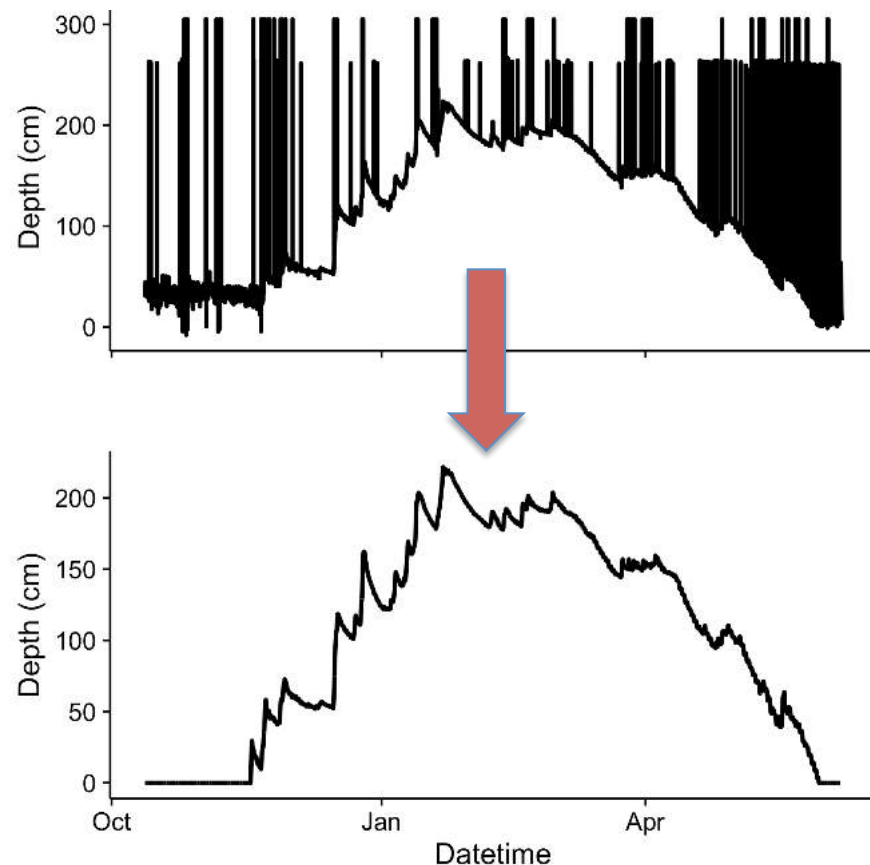


# Methodology Overview



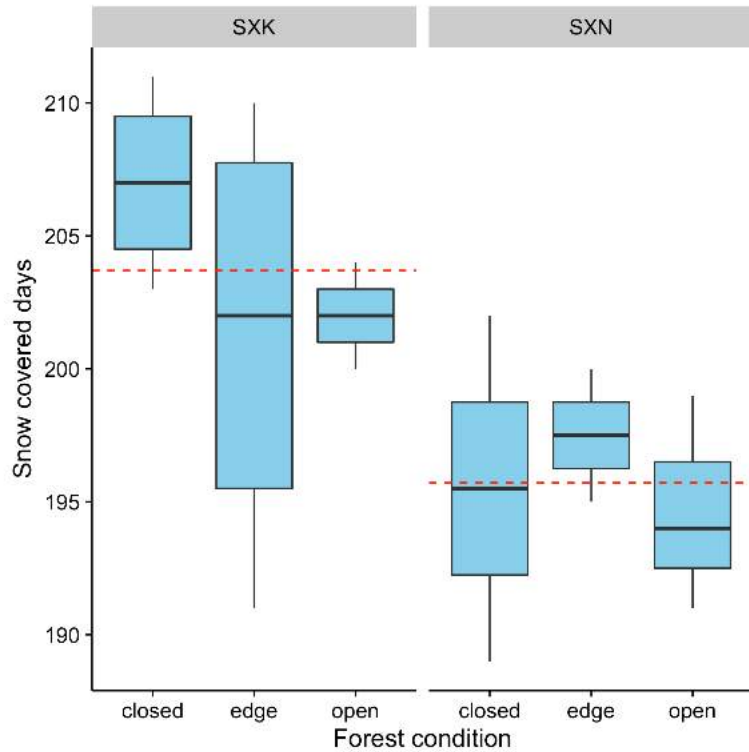
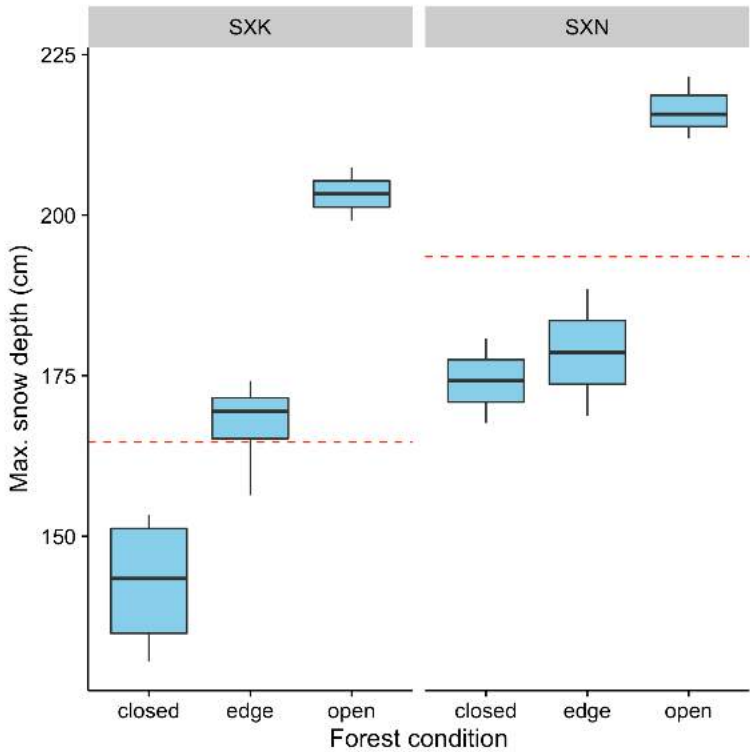
# Data Product

- Continuous, multi-level dataset
  - Raw, quality controlled, infilled, and smoothed
  - Method flagging for each data level
- Precise coordinates for each sensor
- Site photos
  - Hemispherical photos to be acquired Fall 2017

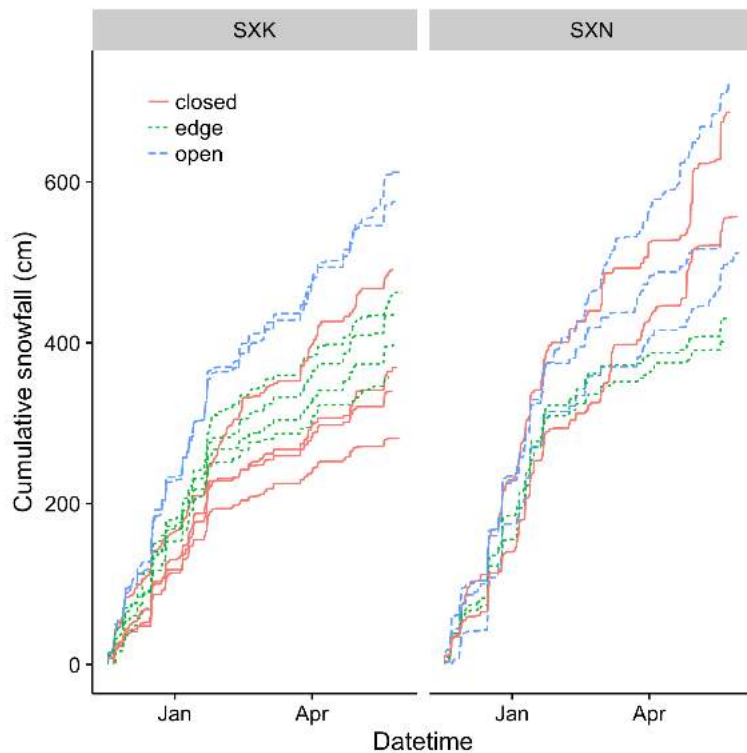
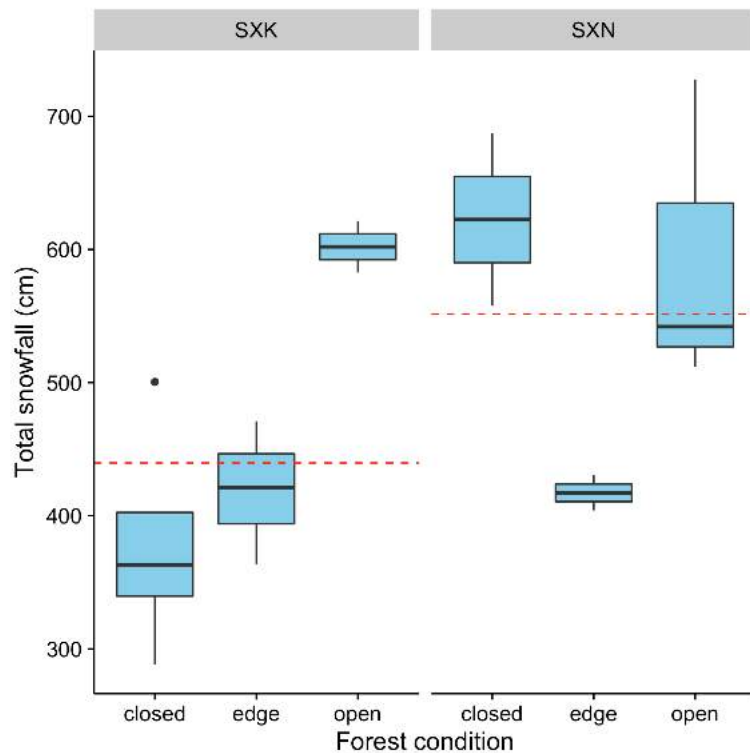




# Preliminary Analysis

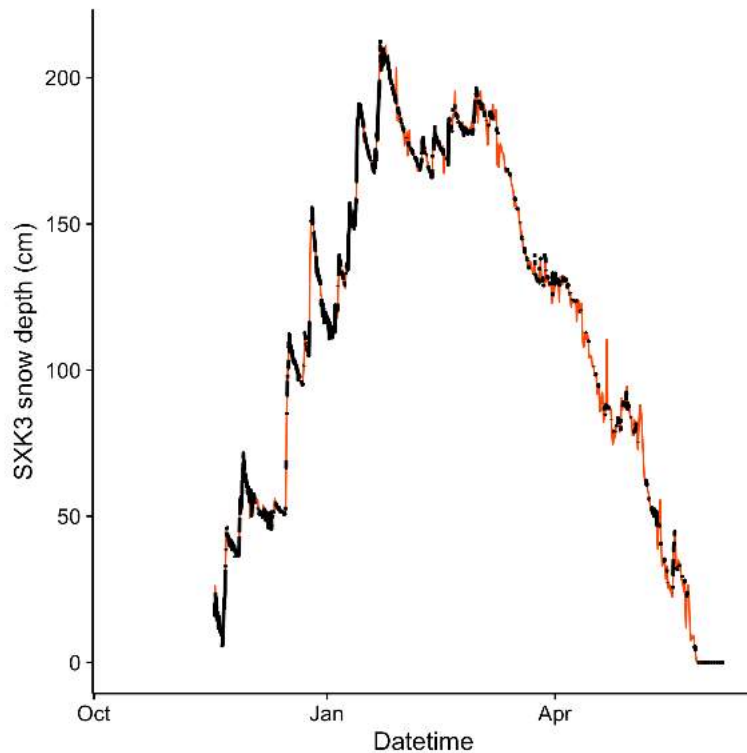
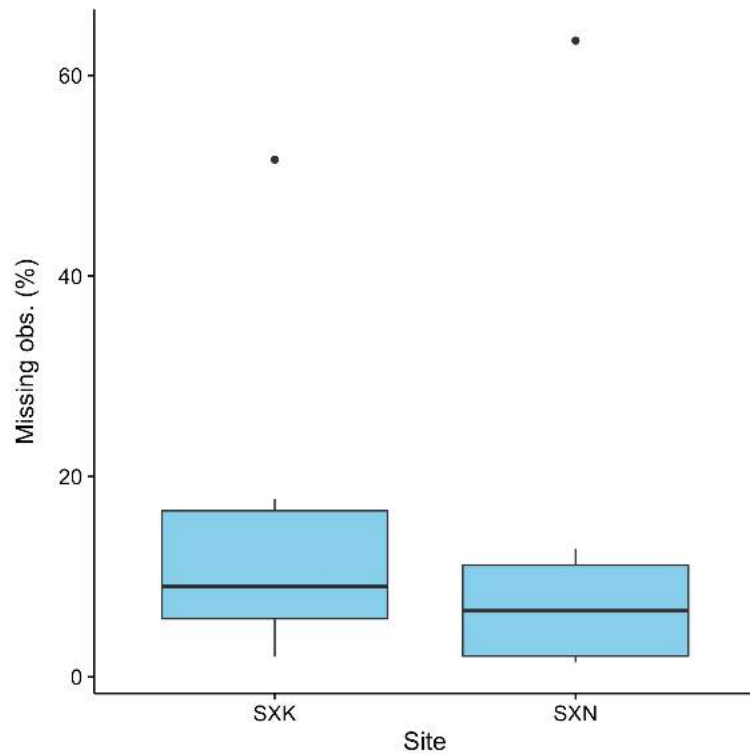


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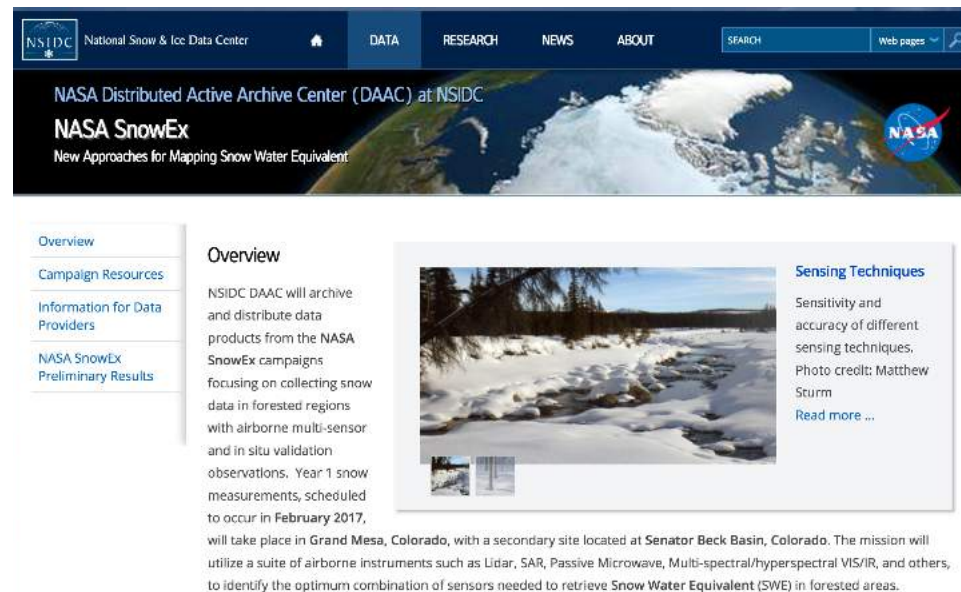


# Applications

1. Validation of remote sensing products
  - a. Geolocated depth sensors provide high spatial precision and temporal resolution
2. Observations of snow depth variability between TLS scans
3. Forcing and validating models

# Data Availability

- NSIDC SnowEX portal
- Contact:
  - Keith Jennings  
*keith.jennings@colorado.edu*
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- The entire SnowEX organizing team and participants



# Questions?



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